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A SURVEY OF COMMERCIALLY AVAILABLE AUTOMATIC WASTEWATER SAMPLERS

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FOREWORD

Environmental measurements are required to determine the quality of ambient waters and the character of waste effluents. The Environmental Monitoring and Support Laboratory - Cincinnati conducts research to:

> Develop and evaluate techniques to measure the presence and concentration of physical, chemical, and radiological pollutants in water, wastewater, bottom sediments, and solid waste.
>
> Investigate methods for the concentration, recovery, and identification of viruses, bacteria and other microbiological organisms in water. Conduct studies to determine the responses of aquatic organisms to water quality.
>
> Conduct an Agency-wide quality assurance program to assure standardization and quality control of systems for monitoring water and wastewater.

Included in its investigations, the Instrumentation Development Branch, EMSL, has pursued instrumentation surveys, one of which is summarized in this report. This survey, on automatic samplers, is encapsulated by the tabulation and includes most recent devices available as well as a listing of related references

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ABSTRACT

This is a survey of commercial automatic wastewater samplers that are currently available. Pertinent characteristics for wastewater samplers known to the author are tabularized. Additional comments including short descriptions of each manufacturers' equipment are given. Manufacturers names and addresses are included. A literature review of the more recent reports on automatic wastewater samplers is also included.

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SECTION I

INTRODUCTION

Passage of the Federal Water Pollution Control Act Admendments of 1972 (PL 92-500) and the ensuing National Pollutant Discharge Elimination System (NPDES) permit program have stressed the need for accurate and reliable effluent monitoring.

Under the NPDES permit program, dischargers are required to monitor and report the amount and nature of all waste components so that compliance or noncompliance with the permit can be determined. Fulfillment of permit obligations will require one of the following types of monitoring:

Continuous
Aperiodic
Grab sample
Automatic sampling

Continuous monitoring involves passing the sample over sensors or through an instrument that continually analyzes for specific parameters. Telemetering data into a computer for storage, statistical analyses, and printout are usually included with continuous monitoring. Aperiodic monitoring involves collecting a waste sample at varying intervals when specific parameters are out of tolerance or a change in flow characteristics mandates a sample. A grab sample is a single sample that will characterize a waste stream for a single point in time or over a period of time through which the waste concentrations remained constant.

Automatic sampling involves the collection of waste samples on a time- or flow-proportional basis and these samples are deposited sequentially into either discrete bottles or a single container. It should also be noted that aperiodic samples can be triggered by a continuous monitor and collected into an automatic sampler (STPS).* All of the above methods of monitoring except STPS have been discussed in previous literature and will not be repeated here.

*Triggering an automatic sampler from a continuous monitor is called a Sample Taker Parametric System (STPS) and this system is based upon selected water quality parametric amplitudes, rather than time invariant or flow-proportional parameters. Mentink[1] developed specifications for the STPS which are included in EPA's "Specifications for an Integrated Water Quality Data Acquisition System - Eighth Edition."

The purpose of this report is to bring information on commercially available automatic wastewater samplers up to date for those who require samplers. All U.S. companies that manufacture automatic wastewater samplers are listed with addresses and telephone numbers. Apologies are extended to any company that was inadvertently omitted. Summarized descriptions of different sampler models are tabularized and additional pertinent comments are included. This document does not recommend any particular brand of sampler but merely compiles the available information into one report so that those who require this equipment can make a rational selection.

A program for investigating performance of automatic wastewater samplers, both within the laboratory and in the field, has been initiated by the Instrumentation Development Branch, Environmental Monitoring and Support Laboratory - Cincinnati (EMSL). Laboratory investigations are performed to determine if the sampler complies with manufacturer's specifications for accuracy and precision of timers, flow meters, sample volumes, sample multiplexing, and other characteristics specific to each sampler including electronic control stability. Laboratory investigations also include tests to determine adequacy of cooling through refrigeration or icing, battery endurance, and component failure. Field tests are made to determine if the sample is representative for suspended solids, other parameters, and loss of data because of clogging or other failure.

SECTION II

REVIEW

There are a number of reports that would be helpful to those contemplating purchase of automatic wastewater samplers. Some of these more recent reports will be discussed here.

Shelley and Kirkpatrick[2] describe most of the automatic wastewater samplers that are commercially available and they include the names and addresses of manufacturers so that potential users will know where to purchase this equipment or obtain additional information. They also give an interesting discussion on intakes that includes solids distribution within a stream, and variation of solids collection with intake orientation and intake velocity. Velocity within the sampling train is discussed. Specific examples that illustrate the accuracy of different methods of proportioning including simple composite, volume-proportional to instantaneous flow rate, volume-proportional to flow since last sample, and time-proportional to flow since last sample are given.

Shelley[3] reports on the design and testing of a prototype automatic sewer sampling system. The prototype sampler is described and results of field and lab tests given. Field sampling was to demonstrate reliability and lab testing was to determine representative collection of solids. Synthetic solids were used with specific gravities ranging from 0.92 to 2.65. Four different commercially available samplers were also tested under the same flow conditions as the prototype. Overall performance of the prototype sampler was relatively good for solids with specific gravity of 1.06. Performance of the prototype was more erratic at a specific gravity of 2.65. Performance of the commercially available samplers was more erratic than the prototype at both specific gravities. The report also discusses the requirements of a sampling system when broken down into five basic subsystems that include intake, gathering system, transport, storage, and controls. An interesting discussion of the intake function is presented that includes intake orientation, intake velocity, flow velocity, particle size and solids specific gravity.

Harris and Keffer[4] performed field evaluations on the Sigmamotor, Brailsford, ISCO, SIRCO, Pro-Tech, QCEC, and N-Con samplers. They analyzed samples according to Standard Methods[5] for biochemical oxygen demand (BOD), chemical oxygen demand (COD), and nonfilterable solids (NFS). Data obtained from different compositor

combinations were compared to each other and to those resulting from manual sampling methods. These sampler comparison studies on raw waste showed variations in water chemistry data that were greater than could be explained by laboratory analytical error and variation between samplers for NFS was the most significant.

The U.S. Army[6] has performed an extensive evaluation of different wastewater samplers that included both lab and field studies. Synthetic waters were used in their lab studies and these included tests for representative collection of biologicals, biodegradables, suspended solids, colloids, dissolved gases, and volatile organics. Field tests were for suspended solids and reliability. Conclusions included a ranking of the 16 samplers tested based on physical capability, reliability, and representative sample collection.

Craft, et al,[7] discusses commercially available wastewater sampling and monitoring equipment and includes descriptions of the following water samplers: FMC (Tru-Test), N-Con (Sentinel), Phipps and Bird, QCEC (model E), BIF (Sanitrol), Lakeside (Trebler), Bristol Engineering (model M4), Pro-Tech, Brailsford, and Sigmamotor.

The handbook for monitoring industrial wastewater[8] is an excellent guide that explains different methods of automatic wastewater sample collection and includes a section on the different types of flow-measuring equipment for wastewater flow.

Wood and Stanbridge[9] reported on different samplers that are used in England. Different manufacturers and methods of collection are discussed. Suspended solids results are given for a test in which five samplers drawing from a receptacle containing well-screened sewage were compared with manual samples. Four of the samplers compared favorably and one that used a very low continuous flowrate only collected 77 percent of the average solids. Volumetric accuracy of their U-Tube sampler was best for the samplers that were compared.

Shelley and Kirkpatrick[10] discuss over 70 different generic types of primary flow measurement devices according to the fundamental physical principles involved along with evaluations regarding their suitability for measurement of storm and combined sewer flows. A review of commercially available flow measurement equipment, listing manufacturer and including a description of each device, is given. A review of selected U.S. EPA project experience in flow measurement is presented along with a summary of current ongoing research efforts. The report also includes a review of the characteristics of storm and combined sewer flows, a discussion of the need for such flow measurement, the types of flow data required, and the time element in flow

data. Requirements and desirable features of flow measurement equipment along with an evaluation sheet that can be used for specific application is presented.

NFIC[11] performed a statistical evaluation on Sonford (Serco) samplers to confirm whether manual and automatic sampling methods are equivalent. Their results showed that the vacuum type automatic sampler evaluated in their study, may be used to collect representative wastewater samples on a composite basis. They also suggested sampler modifications to provide adequate sample preservation.

Performance of the Manning model S-4000 wastewater sampler and the model F-3000 flow meter was investigated.[12] The sampler and flow meter were tested at temperatures of 2, 20, and 35C to determine accuracy, precision, and drift. Battery endurance was determined. Discrete sample temperatures versus time were recorded under iced conditions to determine preservation capability. Field tests were performed to determine representative collection of suspended solids and ability of the unattended sampler to collect raw sewage samples over a 24-hour period.

A report on application and procurement of automatic wastewater samplers[13] discusses different sampler characteristics and includes compositing, proportionality, preservation, lift, and power requirements. Application is discussed with reference to compliance with the NPDES Permit program. Selection and procurement of automatic wastewater samplers are included.

Performance investigation of an ISCO model 1391 water and wastewater sampler was reported.[14] Laboratory tests were made to determine accuracy and precision of the timer, flow meter, and sample volumes. Battery endurance was determined and sample temperatures were recorded under iced conditions to determine preservation capability for a 24-hour period.

Methods for Chemical Analysis of Water and Waste[15] should be consulted before sampler purchase to determine the preservatives (such as sample cooling or chemical addition) that may be required for the parameters of interest. Some samplers include an ice chest, others provide mechanical refrigeration, and some permit the addition of more than one preservative; therefore there is a need to consider the type of sample preservation that will be required before sampler purchase.

The Handbook for Sampling and Sample Preservation of Water and Wastewater[16] discusses sampling program objectives, type of sample, use of automatic samplers, flow measurement, sampling techniques, preservation, sampling statistics, and methods.

Figures 1 through 6 depict some typical components of automatic wastewater samplers. Figures 7, 8 and 9 show typical flow meters for collecting samples that are proportional to flow. These specific pictures were chosen for illustration only and they do not constitute endorsement of this equipment or recommendation for use.

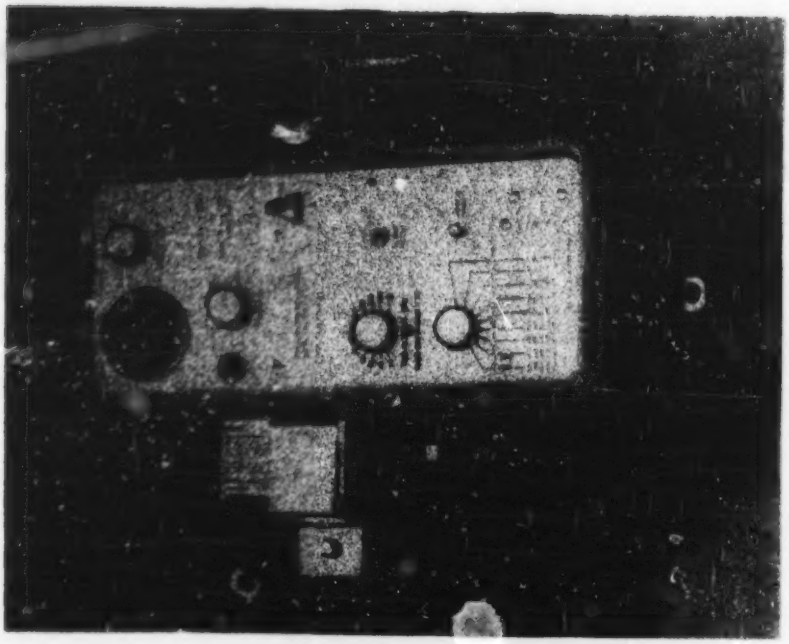

Figure 1. Top of ISCO water sampler, showing pump, controls and battery.

Figure 2. Intake of Manning Model S-4000 water sampler.

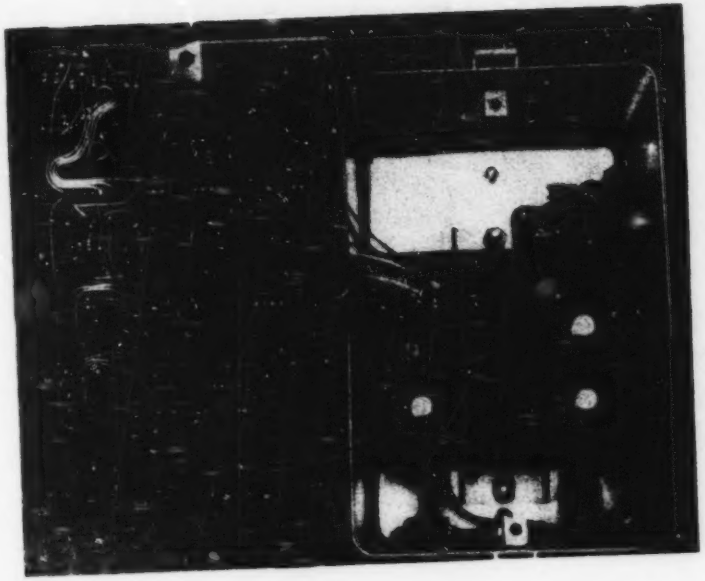

Figure 3. Solid-state control circuitry of Manning Model S-4000 water sampler.

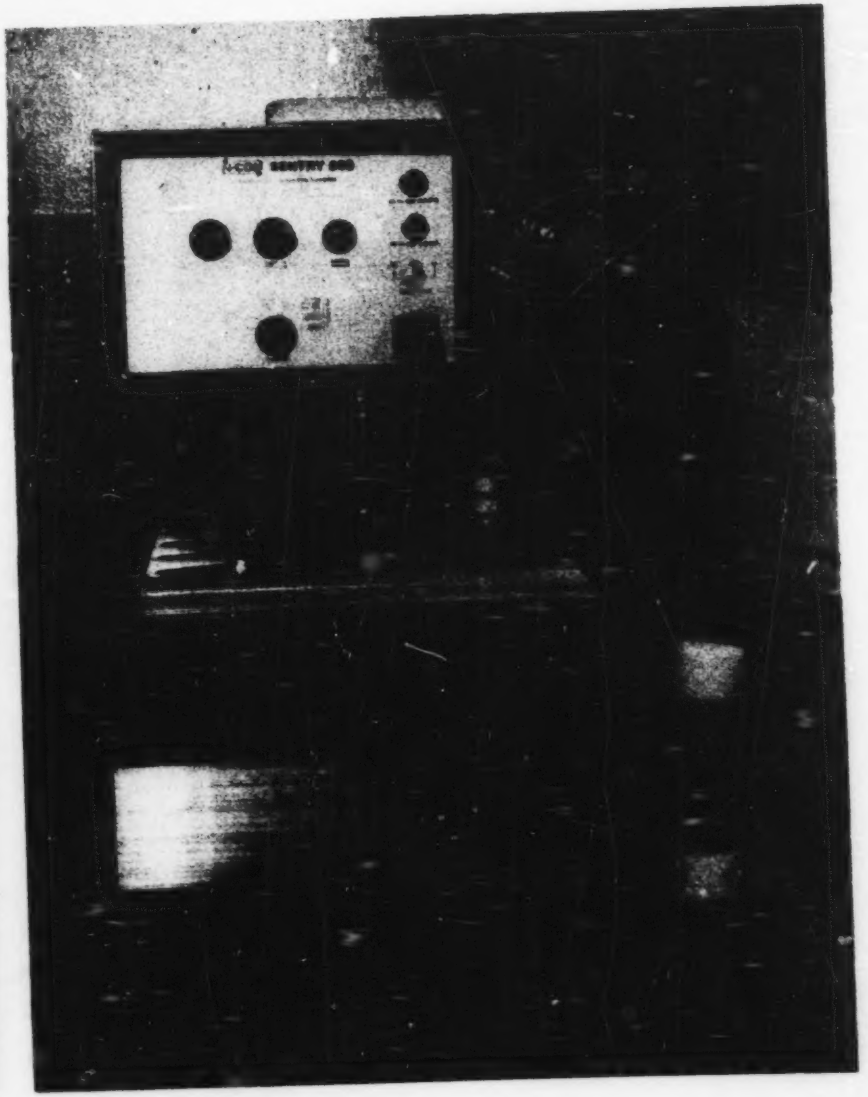

Figure 4. N-Con Sentry 500 water sampler showing intake, bottle rack, stepping arm, pump, and controls.

Figure 5. Sample tray, discrete sample bottles, and ice compartment of ISCO water sampler.

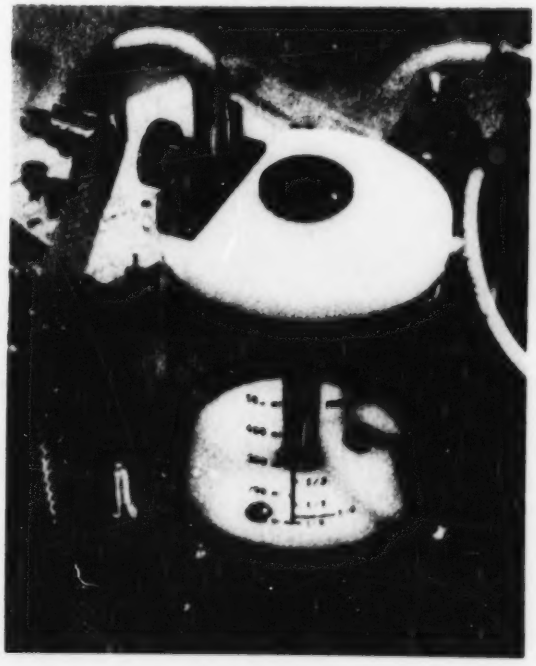

Figure 6. Constant volume chamber of Manning water sampler.

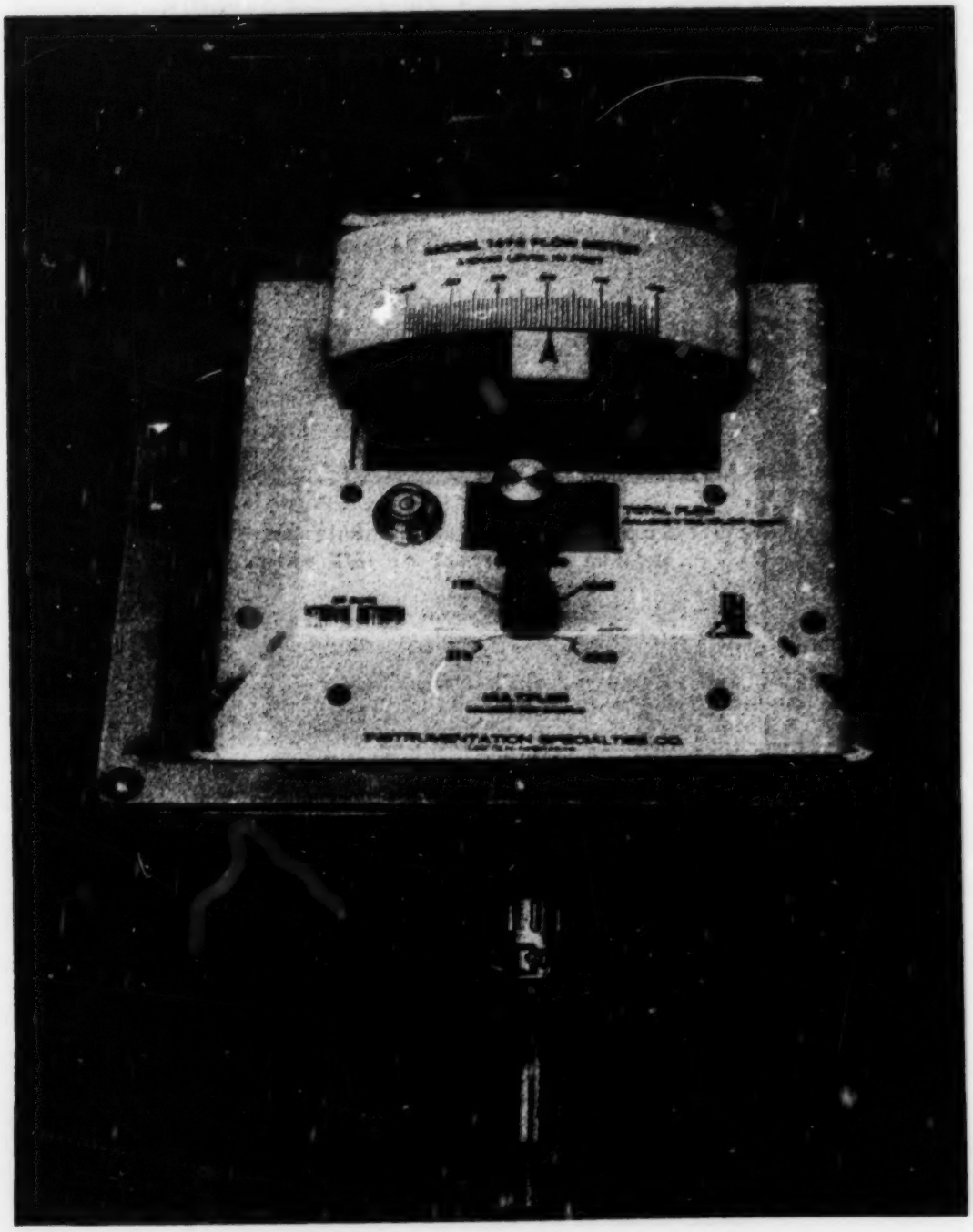

Figure 7. ISCO Model 1470 float-type flow meter.

Figure 8. Manning Model F-3000 dipper-type flow meter.

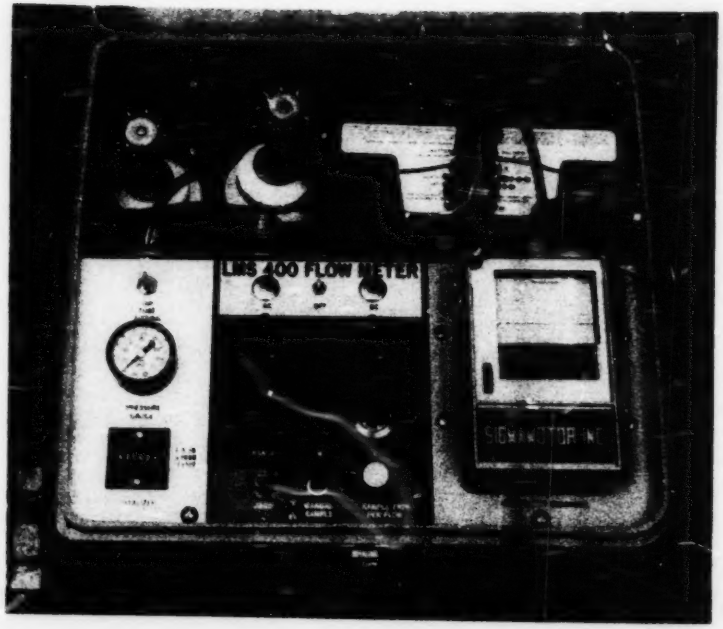

Figure 9. Sigmamotor Model LMS 400 bubbler-type flow meter.

SECTION III

COMMERCIALLY AVAILABLE AUTOMATIC WASTEWATER SAMPLERS

This section of the report includes a tabulation on pages 13 and 14 that illustrates the characteristics of the different samplers provided by 28 manufacturers. One contemplating procurement of commercial wastewater samplers can minimize his catalog research by employing the tabulation. Additional comments including items that would not fit into the table along with manufacturer's addresses are given following the table. There may be a few sampler manufacturers that were inadvertently omitted and these companies are invited to send the Agency their sampler information.

TABULATION

An explanation of the sampler table is in order because tables require succinctness but a little more detail is required, so the following definitions of the headings within the table are given:

Manufacturer - The name given is the company name or the common brand name that is known to the sampler. Complete names, addresses, and phone numbers for each company are included following the table.

Model number - Model numbers include the company's basic model or models. Different models with slight variations may also be available.

Approximate cost - Costs are constantly changing so that quotations can easily differ from the tabulation. Prices given approximate the sampler costs and includes refrigeration for regrigerated models but not the flow meter for flow-proportional models.

Dimensions and Weight - Dimensions and weight are subject to slight variations as manufacturers incorporate modifications to compete in a field that is presently very dynamic.

Sample Bottles - Number of sample bottles is usually fixed. In some cases a compositor that collects multiple discrete samples can be coverted to collect a single composite. Capacity may also be changed on some units to satisfy the user's needs.

MANUFACTURER	MODEL NO.	APPROX. COST ($)	DIMENSIONS BD.x DPTH.x HT. or DIA.x HT. (cms)	WEIGHT (kg)	SAMPLE BOTTLES		TYPE COOLING	MATERIALS EXPOSED TO SAMPLES			Velocity, sample line (cms/sec)	MAX. LIFT (cm H_2O)	INTAKE I.D. (mm)	TYPE OF PUMP	PURGE CYCLE	CONTROLS			POWER				PORTABLE or FIXED
					No.	Cap. (ml)		Bottles	Tubing	Other						Flow Prop.	Time Prop.	Solid State	AC	Batt.	Press.	Spring	
BIF Sanitrol	41-4	670	27.3 x 25.4 xVAR	18.18	1	7570		Nalgene	Tygon	Fiberglass		762		Dipper			X		X				F
Brailsford	EVS-38	672	30.5 x 22.9 x 48.3	8.72	1	3785		Polypropylene	Tygon	Plexiglas	10.2	182	3.16	Vacuum			X		X	X			P
Brailsford	DC-F	296	30.5 x 24 x 48.3	8.72	1	7570		Polypropylene	Tygon	Teflon	23.2	213	3.16	Piston			X			X			P
Brailsford	DU-2	373	30.5 x 22.9 x 48.3	8.72	1	7570		Polypropylene	Tygon	Teflon	23.2	213	3.16	Piston			X			X			P
Brailsford	EP	373	Small	L	1	3785		Polypropylene	Tygon	Teflon	23.2	213	3.16	Piston			X			X			P
BVS	PP-100	700	31.8 x 25.4 x 46	35	1	9463		Plastic	Tygon	PVC		6096	3.16	Pressure			X				X		P
BVS	PPR-100	900	43.2 x 49.5 x 45.1		1	5678	Ref.	Plastic	Tygon	PVC		6096		Pressure			X			X	X		P
BVS	SE-400	2700	61 x 61 x 122	79.5	1	18,925	Ref.	Polyethylene	Plastic	PVC		975	12.7	Submersible			X	X	X				F
BVS	SE-800	2900	61 x 61 x 122	79.5	1	18,925	Ref.	Polyethylene	Plastic	PVC			50.8	Submersible			X	X	X				F
Bristol	M-4KT	941	7.6 x 30.4	3.2	1	3785		Polypropylene		Stainless				Plunger into Pipeline			X	X	X				F
Chandler	SR-10	2245	27.2 x 59.7 x 109	45.4	1	8000	Ref.	Polyethylene	PVC	U	H	671		Vacuum	X		X	X	X				F
Collins	40-2R	1343	50.8 x 61 x 122	100	1	18,925	Ref.	Polyethylene	Polyethylene	Polypropylene	H	610	9.5	Moyno			X		X				F
EBA	200 AC	239	20 x 83	9.1	1	U	Ice	U	Plastic	Aluminum		77	9.5	Solenoid Plunger			X		X	X			F
ETS	FS-4	1100	108 x 46 x 55	31.8	12	3785		Plastic		Noryl	L	883		Peristaltic			X		X				P
Fluid Kinetics	Custom Design						Ref.									X	X	X	X				F
FMC Corp.	Tru-Test	2850	49.6 x 60.4 x 131	147.6	1	7500	Ref.	Polyethylene			93.3	457	50.8	Centrifugal			X	X	X				F
Horizon	7578	600	40.6 x 23.5 x 57.2	12.7	1	9463		Polyethylene	Tygon	Silicone		914	4.8	Peristaltic			X			X			P
Hydrogard	FP	370	10.2 x 74	3.2	1	U		U	Plastic	Stainless			9.5	Pressure		X	X				X		P
Hydra-Numatic	HNS	1980	91.4 x 33.4 x 91.4	90.8	1	18,925		Polyethylene	Tygon	Bronze	75	457	12.7	Impeller		X	X		X				F
ISCO	1392	1200	49.5 x 53.3	18.2	28	500	Ice	Polyethylene	Tygon	Silicone	96.3	790	6.35	Peristaltic	X	X	X		X	X			P
ISCO	1480	800	48.5 x 64.8	14.1	1	11,350	Ice	Polyethylene	Tygon	Silicone	24.1	790	6.35	Peristaltic	X	X	X		X	X			P
ISCO	1580	900	48.5 x 64.8	14.1	1	11,350	Ice	Polyethylene	Tygon	Silicone	96.3	790	6.35	Peristaltic	X	X	X	X	X	X			P
Lakeside	T2	1856		25	1	U	Ref.	U	Plastic	Plexiglas			12.7	Scoop		X			X				F
Manning	S-4000	1350	43.8 x 57.2	18.1	24	500	Ice	Polyethylene	Tygon	Plexiglas	H	670	9.5	Vacuum	X	X	X	X	X	X			P
Markland	1301	1150	43.2 x 30.5 x 71.1	27.2	1	7570		Polyethylene	Tygon	E.P.T.		914	6.35	Pressure			X	X		X	X		P
Markland	2104T-CLK	1250			1	7570		U	Tygon	E.P.T.		914	6.35	Pressure			X	X	X		X		F
N-Con	Surveyor	275	Small	L	1	U		U	U	Buna-N	H	182	12.7	Impeller			X		X				P
N-Con	Scout	520	35.6 x 15.3 x 43.2	10	1	3785		Polypropylene	Tygon	Silicone	12.1	457	6.35	Peristaltic			X		X	X			P

X = HAS, U = USER SUPPLIED, L = LOW, H = HIGH

MANUFACTURER	MODEL NO.	APPROX. COST ($)	DIMENSIONS WD.x DPTH.x HT. or DIA.x HT. (cms)	WEIGHT (kg)	SAMPLE BOTTLES		TYPE COOLING	MATERIALS EXPOSED TO SAMPLES			Velocity in sample line (cms/sec)	MAX. LIFT (cm H_2O)	INTAKE I.D. (mm)	TYPE OF PUMP	PURGE CYCLE	CONTROLS			POWER				PORTABLE or FIXED
					No.	Cap. (ml)		Bottles	Tubing	Other						Flow Prop.	Time Prop.	Solid State	AC	Batt.	Press.	Spring	
N-Con	Sentry	1100	40.6 x 35.6 x 33	15.9	24	450		Glass	Tygon	Silicone	12.1	457	6.35	Peristaltic	X		X		X	X			P
N-Con	Trebler	1600			1	U	REF.	U		PVC		L		Scoop		X			X				F
N-Con	Sentinel		58.5 x 25.4 x 147.4	84	1	7570	REF.	Polyethylene		PVC			50.8	U			X		X				F
NP Enterprises	NPE				1		REF.				H			Vacuum	X		X		X				F
Phips & Bird	8392-300	850			1	U		U		Stainless		305		Dipper			X		X	X			F
Pro-Tech	CG-125	800	33 x 25.4 x 43.2	9.1	1	5678		TFE Resins	TFE Resins	PVC		914	3.16	Pressure	X		X				X		P
Pro-Tech	CG-150	900	33 x 25.4 x 43.2	9.1	1	5678		TFE Resins	TFE Resins	PVC		914	3.16	Pressure	X		X				X	X	P
Pro-Tech	CEL-300	1500	33 x 48.3 x 43.2	13.7	1	5678		TFE Resins	PVC	PVC	99.7	914	12.7	Submersible			X		X				P
Pro-Tech	DEL-240S	5700	76.2 x 81.2 x 182.9		24	100	REF.	TFE Resins	Stainless	PVC	99.7	914	12.7	Submersible			X		X				F
QCEC	CVE	570	38.1 x 38.1 x 80.9	24.9	1	1893	ICE	Glass	Tygon	Plexiglas	H	610	6.35	Vacuum	X		X		X				P
QCEC	E	1000	20.3 x 33 x VAR.	45.4	1	U				Stainless				Dipper			X		X				F
QCEC	CVE II	950	38.1 x 43.2 x 38.1	15.9	1	3785	ICE	Glass	Plexiglas	Brass	H	610	12.7	Vacuum	X		X	X	X	X			P
QCEC	LF	960	39.4 x 7.7	10	1	U		U	U	Stainless				Plunger into pipeline			X		X				F
Sigmamotor	WD-1	650	34.3 x 25.4 x 36.9	14	1	9462		Plastic	Tygon		9.7	670	3.16	Nutating			X		X	X			P
Sigmamotor	WD-5	1100	50 x 37 x 64	27	1	18,925		Plastic	Tygon		4.2	548	6.35	Finger			X		X	X			P
Sigmamotor	WM-4-24	1100	50 x 37 x 64	25.4	24	450		Plastic	Tygon		9.7	670	3.16	Nutating	X		X		X	X			P
Sigmamotor	WM-6-24	1400	50 x 37 x 64	29	24	450		Plastic	Tygon		4.2	548	6.35	Finger	X		X		X	X			P
Sigmamotor	WAP-2	700	34.3 x 25.4 x 36.9	11.4	1	9462		Plastic	Tygon		9.7	670	3.16	Nutating		X			X				P
Sigmamotor	WAP-5	1050	50 x 37 x 64	19.1	1	18,925		Plastic	Tygon		4.2	548	6.35	Finger		X			X				P
Sigmamotor	WM-1-24R	1525	53.4 x 55.9 x 86.4	56.8	24	450	REF.	Plastic	Tygon		9.7	670	3.16	Nutating	X		X		X				F
Sigmamotor	WAC-5R	1300	53.4 x 55.9 x 125	44.5	1	18,925	REF.	Plastic	Tygon		VAR.	670	3.16	Finger		X			X				F
SIRCO	B/ST-VS	1670-2950		127	24	473	REF.	Polyethylene	Plexiglas		H		9.53	Vacuum	X		X		X				F
SIRCO	B/IE-VS	1100-2778		123	1		REF.	Stainless	PVC	PVC		6096		Dipper			X		X				F
SIRCO	B/OP-VS	1376-2772		91	24		REF.	Polyethylene	PVC	Plexiglas				Pressurized reverse			X		X				F
SIRCO	MK-VS	675-1364	40.7 x 40.7 x 55.9	17	1 24	18,140 500		Plastic	PVC	Plexiglas	140	670	9.53	Vacuum	X		X	X	X	X			P
Sonford	NW-3	1000	39.4 x 39.4 x 68	23.2	24	473		Glass	Tygon	Stainless		396	6.35	Evacuated bottles			X					X	P
Sonford	HG-4	500	33.8 x 31.4 x 33.5		1	3785		Polyethylene		Stainless		53		Telescoping tube			X		X	X			P
TMI	MARK 3B	845	36.8 x 66	14.5	12	570		Glass	Tygon	Stainless		300	6.35	Evacuated bottles			X					X	P
TMI	MARK 4B	950	38 x 38 x 47	20.2	24	570		Glass	Tygon	Stainless		300	6.35	Evacuated bottles			X			X		X	P
Tri-Aid Sciences	CUSTOM DESIGN						REF.		Silicone			762	9.53	Peristaltic		X	X	X	X				F
Waste Watcher	CS/TP	1425	20 x 20 x 7	10.5	1	U		U	Tygon	Silicone	34	670	7.9	Peristaltic	X	X	X		X				F

X - HAS, U - USER SUPPLIED, L - LOW, H - HIGH

Type Cooling - This refers to mechanical refrigeration or an ice compartment that is supplied by the manufacturer. If refrigeration is listed, it is included in the price. If not listed, it may be possible for the user to supply his own refrigerator or ice chest.

Materials Exposed to Samples - Materials exposed to the sample are important because these compounds could dissolve into the water sample and interfere with parameters that are of interest. Materials listed in the table are supplied as standard equipment; other materials may also be available on request.

Velocity in Sample Line - Velocity within the sample line is of concern because it should be high enough to keep suspended solids in solution. Relatively high velocity will also reduce the effect of slime growth on the inside surface of the sample tubing.

Maximum Lift - It is always best to install the sampler as close to the waste stream as possible. Theoretically, surface type pumps cannot lift water through a vertical distance of more than one atmosphere; and it is a good rule of thumb not to exceed 1/2 atmosphere.

Intake I.D. - Internal diameter of the sample line must be large enough to allow solids of interest to pass and also to prevent clogging, but increased diameter lowers velocity and solids may be lost.

Type of Pump - Specific waste types and sampling conditions may require a certain type of pump. Different manufacturers incorporate the following types of lifting mechanisms that are referred to in the tabulation:

a) Dipper	g) Moyno	n) Scoop
b) Vacuum	h) Solenoid plunger	o) Pressurized source
c) Piston	i) Finger	p) Evacuated bottles
d) Pressure	j) Nutating	q) Telescoping tube
e) Submersible	k) Peristaltic	
f) Plunger into pipeline	l) Centrifugal	
	m) Impeller	

a) Dipper - a dipper is a small bucket that revolves into the waste stream on a chain or belt and then dumps the sample into a funnel that directs it into a suitable container.

b) Vacuum - vacuum pumps are diaphragm pumps that evacuate a chamber and this allows atmospheric pressure to force the sample into the evacuated chamber and then into the sample container. Automatic solenoid valves are usually incorporated with vacuum pumps and these valves reverse the direction of air flow so that the sample line is blown out before and after taking a sample. Sample does not go through the vacuum pump or the solenoid valve.

c) Piston - piston pumps for samplers are the syringe type that pump at a constant and low flow rate.

d) Pressure - pressure, listed under type of pump in the table, refers to pneumatic ejection of the sample from a chamber within the waste stream through a line and into the sample container.

e) Submersible - submersible pumps are mounted within the waste stream and include the intake, pump, electric motor and power leads.

f) Plunger into pipeline - plunger into pipeline is a method of removing a sample from full pipeline flow that is usually under pressure. A hollowed chamber on the end of a shaft is forced into the pipeline by a pneumatic cylinder or electric solenoid and then withdrawn so that the sample is allowed to drain into a container.

g) Moyno - moyno pumps are positive displacement worm type pumps that are manufactured by Robbins and Myers Corporation.

h) Solenoid plunger - this method is used by Environmental Marketing Associates and is explained on page 21.

i,j,k) Finger, nutating, and perististaltic are three different types of motion applied to the outer tubing surface that result in the same effect. Tubing ware, metering accuracy, flow rate, pressure and power requirements are factors to consider when selecting these pumps.

l) Centrifugal - centrifugal pumps draw sample into the eye of an impeller and centrifugal force expels sample at the periphery with sufficient pressure to overcome friction losses and lift between the pump and the sample container. Centrifugal pumps are not self-priming and the sample line between the eye of the impeller and the waste stream must be filled with water to start the pump.

m) Impeller - impeller pumps that are referred to in the table are semi-positive displacement units that incorporate a rubber impeller and are self-priming for small lifts.

n) Scoop - scoops listed in the table mean the Trebler scoop that is manufactured by Lakeside Equipment Company. Dimensions of the Trebler scoop are such that this device will

collect a sample that is flow-proportional when it is properly installed upstream from a weir or flume.

o) Pressurized source - sample is taken from a liquid flow that is supplied from an external pressure source. No pump is included with the sampler.

p) Evacuated bottles - when this principle is used, a vacuum pump or hand pump is supplied to evacuate the sample bottles. Bottles are sealed with spring clips and these clips are released sequentially through a timer and sample is drawn into the bottle.

q) Telescoping tube - Sonford Products Corporation (Model HG-9) incorporates a hollow telescoping tube that dips into the waste stream and upon return, the sample drains down the inside of the tube and into the sample container.

Purge Cycle - This means that the sample lines are forcibly backflushed before or after the sample is taken. Some samplers backflush the sample line, both before and after the sample is taken.

Controls

a) Flow-proportional samplers are listed in the table, as being flow-proportional only if the company actually manufacturers a flow meter. The price, listed in the table, does not include the cost of the flow meter. The Trebler scoop and Hydragard (Model FP) are exceptions in that these units are inherently flow-proportional when installed upstream from a weir or flume and they do not require an additional flow meter at extra cost. Many of the other samplers that are listed in the table will sample proportional to flow if a flow-proportional signal is supplied by the user.

b) Time-proportional. This is usually included as standard equipment on all of the samplers that are listed.

c) Solid-state. An (X) under solid state means that solid-state circuits are used throughout the controls without mechanical relays, stepping switches, or mechanical timers.

Power requirements - power source requirements of specific samplers are given by an (X) in the table. In all cases, a battery-powered unit will also operate on 115 VAC through an appropriate converter.

Portable or Fixed - (F) or (P) in the table indicates if the unit is fixed or portable, respectively.

Some manufacturers will provide custom designed sampling installations on request and a few manufacturers specialize mainly in custom designed permanent installations. These companies have a line of standard components that they can adapt to the specific needs of the user.

SAMPLER MANUFACTURERS AND ADDITIONAL COMMENTS

1. BIF Sanitrol
   Unit of General Signal Corporation
   P.O. Box 4, 1800 12th Street, SE
   Largo, Florida 33540 Telephone: 813-584-2157

BIF markets a dipper-type sampler with timer that delivers a sample every 1.88, 3, 7.15, or 15 minutes. A flow-proportional contact closure will activate their standard samplers and 4 to 20 ma or 1- to 5-volt signal converters for flow-proportioning are also available at extra cost. Sample cooling with an all stainless steel refrigerator is available. The basic sampler is made of fiber glass including the sampling cup, but stainless steel is also available. Another version of the BIF sampler uses a pump to deliver a continuous flow through a flume with a sampling cabinet. A portion of sample is dipped from this flume on either a time- or flow-proportioned basis. The lower part of the cabinet is refrigerated and this section contains the composite sample container.

2. Brailsford & Company Incorporated
   Milton Road
   Rye, New York 10580 Telephone: 914-967-1820

The Brailsford sampler incorporates either a vacuum or a piston pump. Units are either AC or battery powered. An explosion-proof model is available. These units are lightweight, relatively small in size, and convenient for field use; but an additional ice chest is required if the samples are to be cooled. Samples can be either time-proportioned or linearly-proportioned to water level.

3. Bradywine Valley Sales Company (BVS)
   P.O. Box 243
   Honey Brook, Pennsylvania 19344 Telephone: 215-273-2841

The models PP-100 and PPR-100 are small lightweight gas operated portable samplers. The sample chamber fills by gravity and the sample remains in the chamber until the timer activates a valve that directs pressurized gas (usually Freon) to the chamber. This gas pressure forces the sample into a container. The model PPR includes an absorption refrigerator that operates on 12 VDC. Models SE-400 and SE-600 are larger nonportable units that include a built-in refrigerator. These samplers are powered by 115 VAC and incorporate a submersible pump.

4. Bristol Engineering Company
   204 South Bridge Street
   Box 696
   Yorkville, Illinois 60560 Telephone: 312-553-7161

This type of sampler is used for drawing samples from a pressurized pipeline. It is screwed into the pipeline and a plunger protrudes into the line and withdraws the sample which then drains into a collection container. The number of individual samples is adjusted proportional to time. The standard unit is powered by air pressure at 80 psi. Electrically powered units (120 VAC, 60 Hz) are also available. The price given in the table includes an all solid-state timer, fittings kit, air lines, 1-gallon polypropylene sample bottle, and size change adapter for a wide mouth bottle. Modifications are available to satisfy specific requirements.

5. Chandler Development Company
   1031 East Duane Avenue
   Sunnyville, California 94086 Telephone: 408-738-1060

This sampler uses a Thomas Industrial vacuum pump that will overcome 671 cm of lift. Operation is either time invariant or proportional to a user supplied flow-proportional signal. The smallest restriction within the sampler is 1.9 cm diameter. Internal sampler lines are PVC. The user must supply lines from the cabinet to the waste stream. Volume of each aliquot is variable from 25 to 105 ml.

6. Collins Products Company
   P.O. Box 382
   Livingston, Texas 77351 Telephone: 713-327-4200

Collins provides a 1/2 hp moyno pump that continually supplies a wastewater sample through a stand pipe that is mounted inside of a Plexiglas housing. A timer actuates a three-way valve that turns off the flow through the stand pipe. Water trapped within the stand pipe drains into the sample container. The stand pipe provides a precise quantity of sample for the container (standard is 3 cc every 30 seconds). Refrigeration for the sample container is provided. Continuous high flow rate insures representative solids and flushing of all lines. The smallest restriction within the system is a 3/8 inch ball valve that has a 0.714 cm diameter opening. Collins provides modifications to this system as requested by the purchaser. Flow-proportioning is available when

a user-supplied contact or milliamp signal from a flow meter is supplied. This signal causes the time between samples to vary proportional to flow.

7. Environmental Marketing Associates (EMA)
   3331 Northwest Elmwood Drive
   Corvallis, Oregon 97330 Telephone: 503-752-1541

EMA samplers consist of an outer tube (about 10.2 cm diameter) that extends into the waste stream. A plunger (piston) extends internally to the bottom of the outer tube. Sample enters by gravity through 0.923 cm diameter holes in the plunger. A solenoid is energized from a timer (every 15 sec to 1/2 hr) and the plunger is pulled through a vertical distance within the tube. Sample that is trapped within the lower part of the tube is forced through a line and into the sample container. An insulated chest is provided for icing the sample. This sampler is light in weight and can be battery operated; but most of these units have been powered by 115 VAC and used in fixed locations. EMA samplers can also be controlled form a flow meter through a totalizer and contactor.

8. ETS Products
   12161 Lackland Road
   St. Louis, Missouri 63141 Telephone: 314-878-1703

The model FS4 collects 12 discrete 1-gallon (3,785 ml) samples over a 24-hour period. Samples are pumped continuously at a rate of 1/3 gph (.00035 liter per sec). Continuous sampling has the advantage of drawing some effluent over the entire period, but low sample velocity may impair suspended solids results at locations where solids are high. Discrete samples of large volume makes manual flow proportioning easier and an adequate amount of sample is available for analysis.

9. Fluid Kinetics Incorporated
   3120 Production Drive
   Fairfield, Ohio 45014 Telephone: 513-874-5121

Fluid Kinetics manufactures Streamguard Models FPS-103 and FTS 200 sampling controls, Models PP 60E, PP-71E, and 60EA12D sample pumping systems and the model DA-2451 discrete liquid sampler attachment. They also sell Universal Engineered Systems Incorporated (UES) flow measuring equipment that includes control, totalizing, telemetry, and recording. The company specializes

in adapting these components to collect wastewater samples for the user's application. Specific components can be combined to take single composite or multiple discrete samples that are proportional to time or flow. Mechanical refrigeration is also available. Fluid Kinetics also manufactures the Model GS-100 Liquid grab sampler that collects a grab sample from specific depths within the waste stream.

10. FMC Corporation
    Environmental Equipment Division
    1800 FMC Drive
    Itasca, Illinois 60143 Telephone: 312-893-1800

Refrigeration and/or pumping systems are optional for FMC's Tru-Test Sampler. Sample is pumped from the waste stream into the sample chamber of the sampler; at this point the sample is dipped from the chamber and displaced through a funnel into the sample container. Pumps supplied with the unit give a velocity that is satisfactory for representative suspended solids. FMC recommends the unit for raw waste, primary, and final effluent. True-Test samplers will pass solids up to 1.27 cm in diameter. The sampler uses solid state digital logic circuits that can be programmed to take from three samples per second to one sample every 99.99 minutes. Tru-Test samplers will accept flow meter signals for flow-proportional samples on a constant volume, time varying basis.

11. Horizon Ecology Company
    7435 North Oak Park Avenue
    Chicago, Illinois 60648 Telephone: 312-647-7644

This is a small, portable, battery-operated sampler with peristaltic pump. The unit is lightweight, has rechargeable batteries, and is convenient for field work. Battery condition can be checked with a built-in battery tester. Samples can be taken in intervals of 15 minutes, 30 minutes, or continuously, Sample volume is set with a switch on the control panel.

12. Hydragard Automatic Samplers
    850 Kees Street
    Lebanon, Oregon 97355 Telephone: 503-258-2628

This company makes models HP and FP samplers. The HP is time-proportional from a neumatic pulse relay. Timing is adjustable with a needle valve. Sampling rate is variable from 10 samples per minute to one sample every 30 minutes. The unit requires an

air compressor that is not supplied but can be purchased from Speedair or Thomas Industries. The smallest opening within the sample line for the HP is 1/2 inch. The model FP is flow-proportional and it must be mounted upstream from a user-supplied weir or flume. Both models are approximately 74 cm long and weigh approximately 3.2 Kg. The sample bottle is supplied by the user and neither model is refrigerated. Operation of the flow-proportional unit (model FP) is identical to the model HP except the sampling chamber is a tapered tube and this taper is proportional to the specific weir or flume that is being used. The company also makes a unit for drawing samples from a pipeline.

13. Hydra-Numatic Sales Company
65 Hudson Street
Hackensack, New Jersey 07602 Telephone: 201-489-4191

The Hydra-Numatic weighs 90.8 Kg. and is meant for fixed locations. It includes a 1/4 hp Jabsco pump with flexible impeller. Suction lift is 457 cm. The sampler operates proportional to time and it will also accept signals from an external flowmeter. Intake velocity is relatively high and therefore the sampler should be satisfactory for waste samples that are high in suspended solids. Hydra-Numatic also sells the complete line of BVS samplers.

14. Instrumentation Specialties Company (ISCO)
P.O. Box 5347
Lincoln, Nebraska 68524 Telephone: 402-799-2441

ISCO makes three samplers: model nos. 1392, 1480, and 1580. These units are professionally designed and the company is continually incorporating the latest innovations (such as solid-state digital logic) in their equipment. ISCO samplers are portable, can be installed within manholes, and will operate from either 12 VDC or 115 VAC. Models include both 28-bottle discrete and single composite-type samplers. Sample flow rate appears to be high enough for collecting representative suspended solids samples. ISCO also sells a flow meter that makes the sampler flow-proportional when the flow meter is installed upstream from a weir or flume. When the flow meter is used, sample volume is constant and time between samples varies with flow. ISCO samples are cooled by adding ice to the center of the sample compartment. Multiplexing is available and this option will place up to four samples in one bottle before indexing to the next sample bottle.

15. Lakeside Equipment Corporation
1022 East Devon Street
Bartlett, Illinois 60611 Telephone: 312-837-5640

The Lakeside Trebler is a flow-proportional scoop that is controlled by a timer to dip samples in intervals of from 2 to 60 minutes. The scoop must traverse the entire depth of the waste stream and swing radius can be up to a maximum of 36 inches. For accuracy of flow-proportioning, the end of the scoop should just touch the bottom of the channel. The scoop must be mounted upstream from a weir or flume. It appears that a representative sample would be taken since the entire depth of the waste stream is traversed. The company also sells a mini-trebler sampler that uses direct drive and is therefore more compact. Required power is 115 VAC, 60 Hz. The company also claims the mini-sampler will run for 24 hours from a 12-volt motorcycle battery through an inverter (12 VDC to 115 VAC, 60 Hz). The user must supply a sample container that holds 1 to 5 gallons. Lakeside provides a small refrigerator for the sample. N-Con Systems Company also sells the Lakeside Trebler mini-sampler.

16. Manning Environmental Corporation
120 Dubois Street
Box 1356
Santa Cruz, California Telephone: 408-427-0230

The Manning Model S-4000 collects 24 discrete sequential samples. A vacuum pump is used and sample flow rate is high. Solid-state logic is used in the control function and samples are taken proportional to either time or flow. Time-proportioning uses a quartz crystal clock and flow-proportioning incorporates Manning's portable dipper flow meter. Flow-proportional control provides a constant volume of sample over a variable time interval. This portable fits into manholes and it operates from a rechargeable 12-volt battery. Samples can be cooled by adding ice to the center of the sample compartment. Option of placing multiple samples in one bottle or the same sample in multiple bottles is switch selectable. Placing the same sample in multiple bottles allows addition of different preservatives.

17. Markland Specialty Engineering LTD.
Box 145
Etobicoke, Ontario, Canada Telephone: 416-625-0935

The sample inlet is a flexible duckbill that acts as a check valve. After this inlet chamber is filled, compressed air forces the

sample from the inlet chamber into the sample bottle. The manufacturer states that the duckbill is nonclogging. The unit incorporates a solid-state timer that will accept signals from a user-supplied flow meter. Required air pressure is obtained from the house supply, a separate compressor or a compressed air cylinder for the portable model. The unit may be powered from either 115 VAC or 12 VDC.

18. N-Con Systems Company Incorporated
    308 Main Street
    New Rochelle, New York 10801 Telephone: 914-235-1020

N-Con makes five models of water samplers that include the Surveyor, Scout, Sentry, Trebbler, and Sentinel. The Surveyor, Scout, and Sentry are portable units and the Trebbler and Sentinel are fixed units. The Trebbler is a dipping flow-proportional sampler that N-Con manufacturers under license from Lakeside Engineering Corporation. The other samplers pump the wastewater sample to the unit. These units cover different approaches to sample collection that incorporate different inlet velocities, time- and flow-proportioning, single or multiple discrete composites, and different methods of cooling, including icing and mechanical refrigeration.

19. NPE Enterprises Incorporated
    P.O. Box 69
    Lewiston, New York 14092 Telephone: 716-754-4828

The NPE sampler incorporates a unique vacuum method that accurately measures a precise sample of effluent on a timed-sequence or remote-signal basis. Samplers are composited into a refrigerated and insulated retention chamber. The system is custom-designed for the user's effluent and manufactured according to chemical process equipment standards for permanent installation. Parts that contact either the effluent stream or sample are noncorrosive.

NPE Samplers use a compressor that evacuates a vertical draw tube and a column of effluent is lifted into this tube. The sample falls into a calibrated slide arm that is connected to the draw tube with a Y-fitting. A level sensor within the draw tube initiates a signal that shifts the air control valve and changes draw tube vacuum to pressurized air for backflushing. A ball valve opens and the sample within the side arm is forced into the refrigerated compartment. Liquid does not go through a pump and there are no small restrictions within the system. It does not appear that clogging of the system would be a problem, NPE samplers

incorporate Foxboro flow, pH, and conductivity measuring equipment when specified. The NPE sampler is usually a complete and permanent installation for the user's requirement, however, individual components are also available.

20. Phipps and Bird Incorporated
Sixth and Byrd Streets
P.O. Box 2V
Richmond, Virginia 23205 Telephone: 804-644-5401

This is a dipper-type sampler that is designed to sample trash-laden streams where it is not possible to operate a pump. Power requirement is either 115 VAC or 12 VDC. The sampler can be controlled manually, from a timer, or from an integrated flowmeter signal. The sample container is supplied by the user. Samples can be iced or cooled in a refrigerator that is supplied by Phipps and Bird at extra cost.

21. Pro-Tech
Roberts Lane
Malvern, Pennsylvania 19355 Telephone: 215-644-4420

Pro-Tech offers a variety of portable and stationary samplers. Some of these samplers are powered by gas pressure (nitrogen, air, Freon) and some are electrically powered. Pro-Tech's gas pressure samplers incorporate an inlet chamber with check valve that allows sample to enter the chamber by gravity and then pressure is applied to the chamber, the check valve closes and the sample is forced into the sample container. Pro-Tech's all electric samplers incorporate a submersible pump that provides a continuous flow of sample through the unit and to waste; upon command a solenoid diverts this sample into a collection container for a predetermined length of time. All Pro-Tech samplers are actuated automatically by internally generated signals, and most of these samplers also offer a flow-proportional feature for accepting external triggering (by dry-contact closure) from a variety of flow-measuring devices supplied by others, whether in the form of a pretotalized signal, a series of time-duration signals, or digital pulses. The small portable samplers collect a single composite and the larger stationary units will collect either a single composite sample or 24 discrete samples. Mechanical refrigeration is available on Pro-Tech's stationary units.

22. Quality Control Equipment Company (QCEC)
P.O. Box 2706
Des Moines, Iowa 50315 Telephone: 515-285-3091

QCEC makes sampler models CVE, CVE II, E, AND LF. Models CVE and CVE II operate on QCEC's patented vacuum system that lifts liquid through a suction line into the sampling chamber. The vacuum pump then shuts off and the sample is forcibly drawn into the sample container. Double pressurized blow-down of the sample lines is standard on the CVE II and optional on the CVE. The model E is a dipper sampler that is designed for permanent installations and the company claims that it is clog proof. The model LF sampler incorporates an electrically-controlled air cylinder that moves a shaft in and out of a liquid line or tank. Model LF samplers are leak proof. Standard timed-interval control is basic to all QCEC effluent samplers. Models CVE, E, and LF will accept flow-proportional signals at slight extra cost. The standard model CVE II sampler is all solid state and it will accept 4-20 ma signals from flow meters and perform its own integration to provide flow-proportional sampling. It also accepts time-pulse signals, signals from sampling switches, or will operate on a straight timed-interval basis. The CVE II is available in the standard portable unit, a mechanically refrigerated model, and in a specially-designed housing for suspension in manholes.

23. Sigmamotor Incorporated
14 Elizabeth Street
Middleport, New York 14105 Telephone: 716-735-3616

Sigmamotor makes many different sampler models. Stationary units are powered by 115 VAC and portable models are powered by either 115 VAC or 12-volt batteries. A converter is available for re-charging batteries. Models that supply either single composite or multiple discrete samples are available. Mechanical refrigeration is included on some models. Both flow- and time-proportioning is available. Some models incorporate Sigmamotor's nutating pump and other models use their finger pump. Both of these pump types squeeze the sample through the tubing and sample does not come into contact with any part of the pump. Different Sigmamotor sampler models will respond to one of three types of flow-proportional signals. These are time-variable sample collection in response to a flow-proportional switch closure, time-variable sample collection in response to a varying 4-20 milliamp signal from a user-supplied transmitter and continuous sampling with sample pump flow rate directly proportional to a varying 4-20 milliamp input signal.

Sigmamotor also manufactures their own model LMS-400 battery-operated, open-channel flow meter that enables one to dial-in-all

standard flow and depth equations. It works on the bubbler principle, and is powered by 115 VAC or 12 VDC rechargeable batteries. The LMS-400 is equipped with a pressure sensitive strip chart (for a continuous record of flow) and a digital totalizer that indicates total flow. Flow-proportional input to an automatic water sampler is incorporated within the flow meter and it will indicate the time at which individual samples were taken. Only a sampling of the Sigmamotor samplers are listed in the tabulation as the models were too numerous to list all of them.

24. SIRCO Controls Company
    8815 Selkirk Street
    Vancouver, British Columbia, Canada Telephone: 604-261-9321

SIRCO makes a number of different sampler models. These models include units that are: portable, stationary powered by 115 VAC or battery, single composite, multiple discrete composite, refrigerated, and non-refrigerated. SIRCO samplers can be either time-proportional or they can be controlled from a user-supplied, flow-proportional signal. Different samplers incorporate a lifting mechanism that is either a vacuum pump or a small dipping bucket. The vacuum pump provides relatively high sample velocity and it also backflushes the sample line. Another model is available that collects the sample from a pressurized source and no lifting mechanism is required.

25. Sonford Products Corporation
    100 East Broadway, Box B
    St. Paul Park, Minneapolis 55071 Telephone: 612-459-6065

Sonford makes models NW-3 and HG-4 wastewater samplers. The model NW-3 consists of 24 discrete bottles and lines that are evacuated with a vacuum pump and sealed. A spring-wound timer rotates a tripper arm that releases one tube each hour (on standard unit) and the sample is drawn into the evacuated bottle. This unit is portable and requires no electric power after the bottles are evacuated. The model HG-4 uses a telescoping tube that moves down into the effluent stream and then back up, allowing the sample to flow down the center of the tube and into the sample container. The model HG-4 can be powered from either 115 VAC or a 12-volt battery.

26. Testing Machine Incorporation (TMI)
    400 Bayview Avenue
    Amityville, New York 11701 Telephone: 516-842-5400

TMI sells the Mark 3B, Mark 4B, and Mark 4BE samplers. All three models operate on the evacuated bottle principle and the company includes a hand pump, vacuum gage, and all fittings that are required for evacuating the bottles in the field. Each bottle has a separate tube that leads to the inlet manifold. Models 3B and 4B use a spring driver clock to trip tube clamps that allow sample to be sucked into the bottles. The model 4BE uses a battery-powered clock. The 3B has 12 discrete bottles and the 4B and 4BE will accept either 12 2-liter or 24 1-liter bottles. All three samplers can use 0.57-liter bottles. Standard spring-driven clocks will collect samples at intervals of 1/4, 1/2, 1, or 2 hours and timers that provide intervals different from these are also available. The sampling sequence on the 4BE can be started by an external signal (contact closure) such as provided by a float switch or integrator. This is useful for monitoring storm water or other abnormal events. Sampling stops when the signal is removed.

These samplers are manufactured in England by North Hants Engineering Company LTD. and they are distributed in the United States by Testing Machines Incorporated.

27. Tri-Aid Sciences, Incorporated
161 Norris Drive
Rochester, New York 14610 Telephone: 716-461-1660

Tri-Aid Sciences constructs custom-designed, permanently installed flow-proportional samplers and wastewater monitors. Most of their equipment incorporates noncontacting ultrasonic flow measurement in flumes and half pipes. The flow measurement and sampling control utilizes total solid-state electronics with a versatility that enables it to be used with all primary flow elements and sensing devices. The sampling system pumps a small, continuous flow of wastewater through a sampling diverter valve and returns it to the main wastewater flow. When the sampler control signals a sample is to be taken on the basis of flow, a frequent, small, accurate sample is diverted to the sample bottle that accumulates the flow-proportional composite sample. A peristaltic pump, normally 3/8 inch, 1/2 inch, or 3/4 inch I.D. is used to continuously circulate a portion of the wastewater flow through the sampling diverter valve and return it to the wastewater stream. Suction lift for the pump is approximately 25 feet of water. Power requirements for the sampler are 100 VAC, 5 amps. A flow-through monitor for pH, conductivity, dissolved oxygen, turbidity, and/or other parameters may be included in the sampling line for continuous monitoring and recording.

28. T. A. Baldwin Company Incorporated
16760 Schoenborn Street
Sepulveda, California 91343 Telephone: 213-894-7153

T. A. Baldwin Company manufactures the Waste Watcher model CS/TP sampler. This sampler uses a TAT Engineering Company peristaltic pump and collects a single composite sample. An adapter is available that enables the unit to take 12 discrete samples instead of the single composite. Two sizes of mechanical refrigerators are also available for the Waste Watcher sampler. Sampler controls are solid state except for an electromagnetic counter and relays. The sample line is purged before taking the sample for a period of from 1 to 5 minutes. T. A. Baldwin supplies a flow meter that consists of a Palmer-Bowlus flume that uses a capacitance electrode transducer. The capacitance electrode gives a signal that varies linearly with flow. This signal is totalized and controls the sampler through a dry contact closure so that the sample is taken at a switch selectable multiple of flow; hence a constant-volume, time-variable sample is obtained. Waste Watcher flow meters also include a panel meter, recorder, and totalizing counter. The flow meter is all solid state except for the counter. The flow recorder also shows the time at which the sample was taken.

SECTION IV

DISCUSSION

The National Pollutant Discharge Elimination System (NPDES) Permit Program has stressed the need for effluent monitoring over specified periods for specific parameters. Automatic wastewater samplers are useful tools for collecting samples that will provide the data that are required by NPDES. It is necessary to collect accurate and precise samples that are representative of the waste stream from which they came. These samples will be analyzed and the data obtained will determine permit compliance or noncompliance. It is therefore necessary to pick an automatic sampler that will accurately collect representative samples to provide the required information. The object of this document is to condence, summarize, and localize automatic wastewater sampler information facilitating rational equipment selection. Reading this report, others previously issued, and visiting laboratories engaged in automatic sampling, should provide a tentative user with adequate information for his project.

SECTION V

REFERENCES

1. Mentink, A. F., "Specifications for an Integrated Water Quality Data Acquisition System," 8th Edition with Addenda, Federal Water Pollution Control Administration, Cincinnati, Ohio, January 1968.

2. Shelley, P. E., and Kirkpatrick, G. A., "An Assessment of Automatic Sewer Flow Samplers - 1975," Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available through National Technical Information Service, Springfield, Va. 21161, EPA-600/2-75-065, December 1975.

3. Shelley, P. E., "Design and Testing of a Prototype Automatic Sewer Sampling System," Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available through National Technical Information Service, Springfield, Va. 22161, EPA-600/2-76-006, March 1976.

4. Harris, D. J., and Keffer, W. J., "Wastewater Sampling Methodologies and Flow Measurement Techniques," U.S. Environmental Protection Agency, Region VI, Surveillance and Analysis Division, Technical Support Branch, Field Investigations Section, Kansas City, Mo. 64108, June 1974.

5. APHA, AWWA, WPCF, "Standard Methods for the Examination of Water and Wastewater," 13th Edition, American Public Health Association, Washington, D.C. 20036, 1971.

6. Barkley, J. J., Peil, K. M., and Highfill, J. W., "Water Pollution Sampler Evaluation," U.S. Army Medical Bioengineering Research and Development Laboratory, Fort Deitrich, Frederick, Md. 21701, January 1975.

7. Craft, T. F., and Ingols, R. S., "Wastewater Sampling and Testing Instrumentation," Georgia Institute of Technology Technical Report No. AFWL-TR-73-69, July 1973.

8. U.S. Environmental Protection Agency, "Handbook for Monitoring Industrial Wastewater," Technology Transfer, U.S. Environmental Protection Agency, Washington, D.C. 20460, August 1973.

9. Wood, L. B., and Stanbridge, H. H., "Automatic Samplers," Water Pollution Control, G.B. 67, 1968, (5) 495-520.

10. Shelley, P. E., and Kirkpatrick, G. A., "Sewer Flow Measurement - A State-of-the-Art Assessment," Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available through National Technical Information Service, Springfield, Va. 22161, EPA-600/2-75-027, November 1975.

11. National Field Investigations Center - Denver, "Comparison of Manual (Grab) and Vacuum Type Automatic Sampling Techniques on an Individual and Composite Sample Basis," U.S. Environmental Protection Agency, NFIC, Denver, Colo., September 1974.

12. Lauch, R. P., "Performance Investigation of the Manning Model S-4000 Portable Wastewater Sampler and the Model F-3000 Dipper Flowmeter," Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268. Publication forthcoming.

13. Lauch, R. P., "Application and Procurement of Automatic Wastewater Samplers," National Environmental Research Center, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268, EPA-670/4-75-003, April 1975.

14. Lauch, R. P., "Performance of the ISCO Model 1391 Water and Wastewater Sampler," National Environmental Research Center, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268, EPA-670/4-75-001, February 1975.

15. Methods Development and Quality Assurance Research Laboratory, National Environmental Research Center, Cincinnati, Ohio, "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, Technology Transfer, Washington, D.C. 20460, 1974.

16. Huibregtse, K. R., and Moser, J. H., "Handbook for Sampling and Sample Preservation of Water and Wastewater," Envirex Inc., A Rexnord Company, Environmental Sciences Division, Milwaukee, Wisconsin, U.S. Environmental Protection Agency Contract No. 68-03-2075, Publication forthcoming.